

SECTION 16721

FIRE ALARM SYSTEM

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**Use this Section for new fire alarm systems. Use Section 16722 for additions to existing fire alarm systems. Confirm fire alarm control panel manufacturer and catalog number with the LANL Fire Protection Group.**  
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**Edit this section to suit project requirements.**

**When the project consists only of Fire Protection, include the following specifications as appropriate in the bid package.**

<b>01015</b>	<b>University Furnished Property and Services</b>
<b>01090</b>	<b>Reference Standards</b>
<b>01300</b>	<b>Submittals</b>
<b>01630</b>	<b>Product Options and Substitutions</b>
<b>01700</b>	<b>Contract Close-out</b>
<b>01720</b>	<b>Project Record Documents</b>
<b>15330</b>	<b>Wet Pipe Sprinkler System</b>
<b>15335</b>	<b>Dry Pipe Sprinkler System</b>
<b>15340</b>	<b>Pre-Action Sprinkler System</b>
<b>15350</b>	<b>Deluge Sprinkler System</b>
<b>15360</b>	<b>Wet Pipe Foam Water Sprinkler System</b>
<b>16111</b>	<b>Conduit</b>
<b>16130</b>	<b>Boxes</b>
<b>16190</b>	<b>Supporting Devices</b>
<b>16195</b>	<b>Electrical Identification</b>

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**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Furnish, design, install, test and place into service a complete, electrically operated, totally solid state, single supervised, closed circuit fire alarm system. The system shall operate at a nominal 24 volts DC, and have supervised open contact alarm circuits. The system shall be complete including a control panel, alarm initiating devices, notification appliances, and accessory equipment necessary for a complete system.
- B. Provide a fire alarm system consisting of, but not limited to the following components:
1. Fire Alarm Control Panel (FACP): Equipped with internal controls, power supply, emergency power supply, wiring, terminals, LED's, and switches.
  2. Circuits: Conduit and wiring necessary to connect the alarm system panel to alarm initiating devices, notification appliances and auxiliary equipment.

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**Edit 3 to match project fire alarm system requirements.**  
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3. Initiating Devices: [Thermal detectors] [Ionization type smoke detectors] [Photoelectric type smoke detectors] [Duct smoke detectors] [Manual pull stations] [Flow switch(es)] [Pressure switch(es)] [Valve supervisory switch(es)].

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**Edit 4. to match project fire alarm system requirements. Usually, sounder and signal strobe combination units are for new fire alarm systems. Speaker and signal strobe combination units are for existing systems in which the FACP contains a tone generator and audio amplifier. In some special circumstances, a new installation will require voice evacuation signaling; speaker and signal strobe combination units are required for this application. Coordinate with the LANL Fire Protection Group.**

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4. Notification Appliances: [Sounder and signal strobe combination units. ] [Speaker and signal strobe combination units.]

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**Edit to match project fire alarm system requirements.**

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5. Auxiliary Devices: [Fan shutdown relays] [Damper operation relays] [Door Holders] [Elevator recall relays].

## 1.2 SYSTEM FUNCTIONAL DESCRIPTION

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**Edit to match the project fire alarm system requirements. Projects with high explosives areas or NFPA-70 hazardous areas will require additional specialized equipment and system characteristics not included in this specification.**

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### A. Fire alarm initiating circuits shall function as follows:

1. The operation of any fire alarm manual pull station or any automatic fire alarm initiating device (thermal detector, smoke detector, flow switch, main riser pressure switch, etc.) installed in the fire alarm circuit shall:

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**Edit to match project fire alarm system requirements.**

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- a. Energize the common alarm relay
  - b. Flash the appropriate "zone alarm" LED
  - c. Transmit the fire alarm signal to the Central Alarm Station
  - d. Activate the building audio and visual notification appliances for the fire alarm system in a general alarm mode.
  - e. Activate auxiliary devices including door holders, fan shut-down relays and damper operator relays.
  - f. Initiate elevator recall for fire fighters' service.
  - g. Shut down power to elevator equipment before sprinkler operation in elevator equipment room.
2. The fire alarm evacuation tone shall be the "slow whoop" signal. The evacuation alarm tone and visual alarms shall continue until the operator has operated the alarm silence switch.
  3. The operation of the alarm silence switch will not extinguish annunciator LED on the FACP. The initial receipt of the zone alarm shall cause its associated zone alarm LED to flash until

the system alarm silence switch is operated. In the event that a subsequent new fire alarm is received, the fire alarm evacuation tone shall be restarted, indicating a new zone in alarm.

4. The fire alarm initiating circuits shall be two-wire with an end-of-line resistor. FACP shall sense a closed contact as an alarm, and an open circuit as trouble. The two-wire circuit shall be capable of monitoring any unpowered, normally open sensing device, and shall power and monitor automatic detectors (ionization, photoelectric, etc.) which are designed to operate at a nominal 24 volts DC.

B. Supervisory alarm initiating circuits shall function as follows:

1. The operation of any supervisory device (PIV switch, low pressure switch, etc.) shall cause appropriate supervisory signal indication and annunciation at the FACP. The supervisory condition shall continue until the supervisory initiating device has been restored to normal. The actuation of the audible silence switch shall not extinguish supervisory zone indicator lights. In the event that subsequent new supervisory alarms are received, the sequence shall be repeated.
2. The supervisory alarm initiating circuits shall be two-wire with end-of-line resistor and shall sense a closed contact as an alarm, and an open circuit as trouble. The two-wire circuit shall be capable of monitoring any unpowered normally open sensing devices.

C. Initiating circuit trouble signal shall function as follows:

The loss of supervision in an initiating circuit shall cause the associated yellow "zone trouble" LED to flash, and the audible trouble signal shall be actuated. The silencing of the trouble signal and its acknowledgment when a fault occurs in an alarm zone, shall not prevent the resounding of the trouble signal in the event of subsequent fault conditions on other zones, alarm signal circuits or other panel trouble conditions.

D. System trouble signal shall function as follows:

The FACP shall contain an audible trouble alarm signal which will sound if there is any system trouble condition (control circuit fault, panel trouble, initiating circuit fault, notification circuit fault, etc.) and the associated LEDs shall flash. The actuation of the audible silence switch shall silence the audible trouble signal. AC power failure circuit shall not "latch in".

### 1.3 SUBMITTALS

A. Provide the following submittals according to the requirements of Sections 01300:

1. Submit the following calculations at least 30 days prior to scheduled start of fire alarm system installation:
  - a. System battery capacity calculations.
  - b. Audible signal distribution calculations.
  - c. Voltage drop calculations.
2. Submit catalog data at least 30 days prior to scheduled start of fire alarm system installation for all equipment furnished under this Section.
3. Submit certifications as follows:
  - a. Within 30 days after Notice to Proceed, submit certifications of the qualifications of the fire alarm installing firm as described in Paragraph 1.4 of this Section.
  - b. Within 30 days after Notice to Proceed, submit certifications of the qualifications of

the fire alarm system technician as described in Paragraph 1.4 of this Section.

- c. Provide certification from the fire alarm control manufacturer that proposed alarm initiating devices, alarm appliances, and auxiliary devices are compatible with the FACP and other auxiliary equipment..
  - d. Provide "Certificate of Completion" and associated documentation for the completed system according to NFPA 72 prior to the system acceptance test.
4. Submit installation instructions at least 30 days prior to scheduled start of fire alarm system installation.
5. Submit materials and parts lists at least 30 days prior to scheduled start of fire alarm system installation.
6. Submit shop drawings as follows:
  - a. Prepare floor plan drawings using a minimum scale of 1/8" - 1'0" for plans and 1/4" = 1'-0" for details.
  - b. Hand lettering shall be a minimum of 3/16" and other lettering a minimum of 1/8" to permit microfilm reductions.
  - c. Show location of FACP, all fire alarm appliances, conduit layout, quantity and type of wires in each conduit, and interface with other systems for functions such as central station signaling, fan shutdown, damper operation, and elevator recall.
  - d. Show layout of the FACP indicating location of components, interconnection of components, and connections to alarm initiating, indicating, and auxiliary circuits.
  - e. Submit shop drawings at least 30 days prior to scheduled start of fire alarm system installation.
7. Submit test reports as follows:
  - a. Submit a report of the pre-final tests indicating system status and corrective actions required before the final acceptance tests.
  - b. Submit a test plan for the final acceptance tests at least 30 days prior to scheduled final acceptance tests.
  - c. Submit a report of final acceptance tests according to requirements in NFPA 72.
8. Submit wiring diagrams as follows:
  - a. Provide terminal-to-terminal wiring diagrams for alarm and supervisory circuits and interfaces with other systems.
  - b. Submit wiring diagrams at least 30 days prior to scheduled start of fire alarm system installation.
9. Submit operating and maintenance data.
10. Submit project record documents as follows:
  - a. Provide updated shop drawings reflecting as-built conditions showing the work completed under this Section. Include notes on special systems or devices, new and existing, locations and actual conduit installation. Include conduit size, conductor size, and number of conductors per conduit.

- b. Provide the updated shop drawings on Mylar reproducible media and on electronic media in AutoCADD “\*.dxf” or “\*.dwg” format.

11. Submit warranties.

#### 1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with the applicable sections of NFPA 72, *National Fire Alarm Code*, NFPA 101, *Life Safety Code*, and NFPA 70, *National Electrical Code*.
- B. Qualifications of the Installing Firm: The installing firm shall:
  - 1. Be licensed by any state in the United States to engage in the design, fabrication and installation of fire alarm systems.
  - 2. Have satisfactorily installed at least twenty fire alarm systems of equivalent nature and scope to the system described in this Section.
  - 3. Provide the services of a qualified fire alarm system technician to design the fire alarm system and to test the completed system.
  - 4. Be a factory certified representative of the manufacturer of the FACP that will be used on this project.
- C. Qualifications of the fire alarm system technician: The fire alarm system technician shall:
  - 1. Be factory trained and certified in the theory, operation, installation, and troubleshooting of the FACP that will be used for this project.
  - 2. Have satisfactorily designed at least twenty fire alarm systems of equivalent nature and scope to the system described in this Section.
  - 3. Have satisfactorily field tested at least twenty fire alarm systems of equivalent nature and scope to the system described in this Section.
  - 4. Be NICET (National Institute for Certification in Engineering Technologies) Fire Alarm Certified, or certified by an equivalent organization acceptable to the LANL Authority Having Jurisdiction.

#### 1.5 PRODUCT HANDLING

Materials and Equipment: Protect materials and equipment from damage during shipping, storage and installation.

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**Add special product handling requirements for the facility in which this system is to be installed.**  
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### PART 2 PRODUCTS

#### 2.1 GENERAL

- A. Provide fire alarm system components that will operate satisfactorily at an altitude of 7,500 ft above sea level.

B. Materials and Equipment:

1. Provide materials and equipment that are new and unused, free of defects, specifically designed for the use intended, conform to the requirements of NFPA 70 and NFPA 72, and are UL listed or FM approved.

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**Select and edit paragraph 2.2, 2.3 or 2.4 to match project fire alarm system requirements. Confirm FACP selection with the LANL Fire Protection Group.**  
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2.2 FACP AND COMPONENTS - AUTOCALL

- A. Provide the FACP described below.
- B. The FACP shall be modular, of dead front construction for flush mounting, using solid-state components to operate the system. Detection-initiating circuits shall meet the requirements for power limited applications as defined in Article 760, NFPA 70. The FACP and associated devices shall conform to NFPA 72. It shall contain an audible system trouble signal, a system trouble/acknowledge (audible silence) switch, an alarm silence switch, a lamp test switch, an audible disconnect switch, a system reset switch, an enable/disable key switch (key to be removable in the disabled position only).
- C. Indicating lights shall be solid state light emitting diodes (LEDs) to provide reliability and long life. The following LEDs to monitor the FACP status shall be on the face of the panel: 120 VAC line power (green, normally on), supervisory power system (green, normally on, battery trouble (yellow), ground condition (yellow), auxiliary circuit trouble (yellow), system trouble (yellow), supervision trouble (yellow), system fire alarm (red), alarm silence "On" (red), alarm circuit trouble (yellow), trouble silence "On" (yellow), trouble (yellow). In addition to the above LEDs, provide two additional LEDs for each detection zone to indicate a zone alarm (red) and a zone circuit trouble (yellow).
- D. Screw terminals shall be provided for field wire terminations in the panel: power circuits No.12 AWG wire, low voltage circuits No.16 and No.18 AWG wire.
- E. The FACP shall have means for sending alarm, supervisory, and trouble signals by two way data communications with the Laboratory computerized site alarm system (BRASS); "field concentrators," where required, will be GFE.
- F. Provide the number of fire and supervisory alarm zones shown on the Drawings plus 25% additional zones as spares.
- G. Alarm initiating circuits: An open circuit condition shall be processed as a fault or trouble condition. A trouble condition shall be indicated by a flashing amber "zone" LED, a flashing amber "trouble" LED, an audible trouble signal, and the remote trouble signals. The trouble signals shall "latch in" until the reset switch has been actuated. The restoration of the circuit to a normal condition after the acknowledgment of the fault by actuation of the "audible silence" (trouble) signal and the reset switch shall cause the system to return to normal.
- H. Manual control switches: Exposed FACP switches shall be disabled when the key switch is in the disable position, with the exception of the audible silence (acknowledge) switch. The audible silence switch shall be a momentary switch and shall silence only the FACP trouble signal and change flashing LEDs to a steady "on" state. Any maintained contact switches (except the key switch) shall be supervised to initiate a trouble condition (local and remote) when the switch is in the abnormal position, and the key switch is in the enabled position.
- I. Control annunciator: The FACP shall be provided with a modular annunciator section which indicates the FACP (not zone) status and includes all LEDs and switches called for in the systems functional description for this panel.

- J. Power supply: Provide a power supply module to supply power for the entire system. Input power shall be a dedicated 20 AMP circuit, commercial 120-volt AC, 60 Hz, single-phase, two-wire, with ground. System output power shall be supervised 24-volt DC.
- K. Emergency power supply: Provide a battery charger and standby batteries to provide power for the complete fire alarm system and sound any alarms in the event of loss of 120-volt AC power. The batteries shall be sealed gel/cell with sufficient capacity to sound all alarms simultaneously for a period of 10 minutes after 24 hours of operation on back-up power. The charger module shall be capable of recharging the batteries fully within 24 hours after the restoration of normal 120-volt AC power. Under normal charging service, the charger module shall charge the battery at a high rate and automatically switch to a low maintenance rate of charge when the battery is fully charged. The battery charger circuit module shall be current limited to prevent damage in the event of a short circuit in the system.
- L. FACP must be field configurable by the LANL support services contractor.

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**Confirm FACP catalog number with The LANL Fire Protection Group.**

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- M. Manufacturer: Autocall "\_\_\_\_\_", no substitutions.

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**Select and edit paragraph 2.2, 2.3 or 2.4 to match project fire alarm system requirements. Confirm FACP selection with the LANL Fire Protection Group.**

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**2.3 FACP AND COMPONENTS - EDWARDS SYSTEM TECHNOLOGY**

- A. Provide the FACP described below.
- B. The FACP shall be an Intelligent Response Controller. The master controller shall be modular for ease of installation, maintenance, and configuration. The controller shall have an 80 character Liquid Crystal Display (LCD) with (2) 40 character lines.
- C. The controller shall differentiate between smoke detector long-term drift above the pre-alarm threshold (Maintenance alert, indicative of the need for cleaning) and a fast rise above the pre-alarm threshold (indicative of a smoldering fire). The Maintenance Alert shall be annunciated as an alert on the LCD only and shall not be confused as a Trouble or an Alarm.
- D. The unit shall contain a real time clock, tactile feel keypad (16 keys), with 10 functions, (2) buttons for scrolling system status and alarm data on the LCD, (4) front panel switches for Reset Alarm, Trouble Silence, and Drill/All Call, and (5) LED's for Normal, Alarm, Supervisory, Trouble and Test Program.
- E. Screw terminals shall be provided for field wire terminations in the panel: power circuits No.12 AWG wire, low voltage circuits No.16 and No.18 AWG wire.
- F. The FACP shall have means for sending alarm, supervisory, and trouble signals by two way data communication with the Laboratory computerized site alarm system (BRASS); "field concentrators," where required, will be GFE.
- G. Provide the number of fire and supervisory alarm zones shown on the Drawings plus 25% additional zones as spares.
- H. During the normal state, the NORMAL LED (green) shall flash, the first line of the LCD shall display the time in (HH:MM:SS) as well as the number of active points ("AP") and the number of disabled points ("DP") in the system.

- I. When the FACP goes into the alarm condition, the (green) NORMAL LED extinguishes and the (red) ALARM LED shall light, and the LCD indicates the time, the number of messages waiting, the type of alarm, the alarm zone or device number, and the time the alarm occurred. The second line is dedicated to the user specified message. To acknowledge the alarm, the operator shall press the NEXT/ACK button, and the buzzer shall silence. To silence audible devices, the operator will press the ALARM SILENCE button, a new alarm shall cause the audible devices to resound. To reset the network, the operator shall press the RESET button.
- J. During the TROUBLE condition, the amber TROUBLE LED shall light, the NORMAL LED shall go out. The display shall indicate "SURPERV. OPEN" and the zone or device number. The operator will acknowledge all messages by pressing the TROUBLE SILENCE button.
- K. During the SUPERVISORY condition, the amber SUPERVISORY LED shall light, the NORMAL LED shall go out. The LCD shall indicate ("SUPERV. SHORT") and the zone number. The operator will acknowledge all messages by pressing the TROUBLE SILENCE button.
- L. Each controller shall contain an RS-232 printer/programming port and IOP card for programming locally via an IBM PC or down loading through modems from a remote PC.
- M. Power supply: Provide a power supply module to supply power for the entire system. Input power shall be a dedicated 20 AMP circuit, commercial 120-volt AC, 60 Hz, single-phase, two-wire, with ground. System output power shall be supervised 24-volt DC.
- N. Emergency power supply: Provide a battery charger and standby batteries to provide power for the complete fire alarm system and sound any alarms in the event of loss of 120-volt AC power. The batteries shall be sealed gel/cell with sufficient capacity to sound all alarms simultaneously for a period of 10 minutes after 24 hours of operation on back-up power. The charger module shall be capable of recharging the batteries fully within 24 hours after the restoration of normal 120-volt AC power. Under normal charging service, the charger module shall charge the battery at a high rate and automatically switch to a low maintenance rate of charge when the battery is fully charged. The battery charger circuit module shall be current limited to prevent damage in the event of a short circuit in the system.
- O. The system shall be installed in two cabinets with two face plates, one cabinet shall contain the panel itself, the other shall contain batteries and other components.

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**Confirm FACP catalog number with the LANL Fire Protection Group.**  
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- P. Manufacturer: Edwards "IRC-3", no substitutions.

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**Select and edit paragraph 2.2, 2.3 or 2.4 to match project fire alarm system requirements. Confirm FACP selection with the LANL Fire Protection Group.**  
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## 2.4 FACP AND COMPONENTS - FIRE CONTROL INSTRUMENTS

- A. Provide the FACP described below.
- B. The FACP will be an intelligent analog fire FACP. The microprocessor based FACP will include control equipment, power supply, initiating circuitry and alarm circuitry. FACP can also be used as a stand alone relay panel capable of transmitting both alarm and trouble signals independently.] All FACP equipment will be by the same manufacturer; "hybridized" systems containing equipment from different manufacturers will not be acceptable.
- C. The fire alarm system will be programmable through the use of an on-board two digit display and programming switches on the system control unit, input zone units, notification units and relay



units. The FACP will have an 80-character, back-lit, alpha-numeric liquid crystal display which indicates events stored in the system event log, the status of all analog addressable monitor and control points, and provides diagnostic fault codes/messages. A 12-key keypad allows access to the system. The keyboard display unit will contain system status LED's. The FACP will include a fire alarm override to assure that no alarms will be missed while the panel is in the programming mode. Systems which must be "off-line" for programming are not acceptable.

- D. The system will be capable of two modes of degraded operation to assure reliable system operation under adverse conditions:
  - 1. In the event of a failure of the main system processor, each subordinate processor will be capable of operating a general alarm program.
  - 2. In the event of a multiple processor failure, the system will automatically revert to a mode which will operate the system in a general alarm mode. Activation of any initiating device will automatically operate all notification devices in a non-coded pattern and will notify the Central Alarm Station.
- E. The system will incorporate a supervised RS-232C serial output port to operate remote printers and/or CRT's to provide an 80 column readout of all alarms and troubles showing locations, descriptions, times and dates. Communications will be standard ASCII code operating at 1200 baud.
- F. When an alarm condition occurs on a zone, the FACP will indicate the alarm condition until manually reset. An alarm may be acknowledged by the actuation of the "ACKNOWLEDGE" switch. This will silence the panel buzzer and change the "SYSTEM ALARM" LED and the individual zone LED from flashing to steadily lit. All alarm signals may be silenced by actuating the "SILENCE" switch. This will steadily illuminate the "SIGNAL SILENCE" LED. If a subsequent alarm is activated, the alarm signal will re-sound until again silenced. Once silenced, all alarm signals may be restored again by de-activating the "SILENCE" switch. Waterflow zones will be non-silenceable. All alarm signals will be automatically "locked in" at the FACP until the operated device is returned to its normal condition and the FACP is manually reset.
- G. A green "POWER ON" LED will be normally lit, indicating that the FACP is receiving 120 VAC electrical power. A failure of normal FACP power will cause this LED to go out.
- H. An amber "SYSTEM TROUBLE" LED will illuminate and the system audible signal will steadily sound when any trouble is detected in the system. Failure of normal power, opens or shorts or grounds in the initiating or notification circuits, failure of the microprocessor or any identification module condition will activate this circuit.
- I. FACP will be contained in a 16-gauge steel cabinet with red or beige finish. All groups of circuits or common equipment will be clearly marked and will be expandable by inserting interchangeable units.
- K. Screw terminals will be provided for field wire terminations in the panel: power circuits No.12 AWG wire, low voltage circuits No.16 and No.18 AWG wire.
- L. The FACP shall have means for sending alarm, supervisory, and trouble signals by two way data communication with the Laboratory computerized site alarm system (BRASS); "field concentrators," where required, will be GFE.
- M. Provide the number of fire and supervisory alarm zones shown on the Drawings plus 25% additional zones as spares.
- N. Power supply: Provide a power supply module to supply power for the entire system. Input power shall be a dedicated 20 AMP circuit, commercial 120-volt AC, 60 Hz, single-phase, two-wire, with ground. System output power shall be supervised 24-volt DC.

- O. Emergency power supply: Provide a battery charger and standby batteries to provide power for the complete fire alarm system and sound any alarms in the event of loss of 120-volt AC power. The batteries shall be sealed gel/cell with sufficient capacity to sound all alarms simultaneously for a period of 10 minutes after 24 hours of operation on back-up power. The charger module shall be capable of recharging the batteries fully within 24 hours after the restoration of normal 120-volt AC power. Under normal charging service, the charger module shall charge the battery at a high rate and automatically switch to a low maintenance rate of charge when the battery is fully charged. The battery charger circuit module shall be current limited to prevent damage in the event of a short circuit in the system.

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**Confirm FACP catalog number with the LANL Fire Protection Group.**  
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- P. Manufacturer: Fire Control Instruments "7200 SERIES", no substitutions.

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**Use paragraphs 2.5 OR 2.6 to match project fire alarm system requirements. In general, devices specified in 2.5 are for new fire alarm systems and devices in 2.6 are for existing systems in which the FACP contains a tone generator and audio amplifier. In some special circumstances, a new installation will require voice evacuation signaling; devices specified in 2.6 are required for this application. Coordinate with the LANL Fire Protection Group.**  
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## 2.5 SOUNDER AND SIGNAL STROBE COMBINATION DEVICES

- A. Provide UL listed 24 VDC audio-visual combination-type electronic slow whoop sounder and strobe combination units that are acceptable to the FACP manufacturer and are compatible with the FACP.
- B. Sounder shall include slow-whoop generating electronics, audio transducer and screw terminals housed behind a red enamel finished square grille. Sound output shall be field-selectable in at least three steps to at least 99 dBA at 10 feet. Acoustical output shall meet requirements of UL 464.
- C. Strobe signal candela output and flash rate per UL 1971 and ADAAG requirements, with xenon flash tube and electronics enclosed in a clear Lexan lens with "FIRE" in red lettering.

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**Edit D. to match project fire alarm system requirements.**  
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- D. Provide back boxes and mounting plates for [flush-mounting] [surface-mounting] [surface-mounting outdoors].
- E. Manufacturer: Wheelock, Model MT-24-LSM-VFR.

## 2.6 SPEAKER AND SIGNAL STROBE COMBINATION DEVICES

- A. Provide UL listed audio-visual combination-type speaker and 24 VDC strobe combination units that are acceptable to the FACP manufacturer and are compatible with the FACP .
- B. Speaker, multi-tapped audio transformer, blocking capacitor and screw terminals housed behind a red enamel finished rectangular grille. Audio input shall be 25V. Sound output shall be field-selectable in not less than four steps from 1/8 watt to 2 watts and not less than 75 dBA at 10 feet.
- C. Strobe signal candela output and flash rate per UL 1971 and ADAAG requirements, with xenon

flash tube and electronics enclosed in a clear Lexan lens with "FIRE" in red letters.

- D. Combination housing shall have a red finish with "FIRE" prominently displayed.

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**Edit E. to match project fire alarm system requirements.**

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- E. Provide back boxes and mounting plates for [flush-mounting] [surface-mounting] [surface-mounting outdoors].
- F. Manufacturer: Federal Signal, Model SPAFA-25RHR

**2.7 MANUAL PULL STATIONS**

- A. Provide double-action, non-coded manual pull stations with single-pole , single-throw circuit arrangement, that are acceptable to the FACP manufacturer and are compatible with the FACP .
- B. The pull station shall be rigid metal construction and with an all red finish, with the word "FIRE" in white letters.

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**Edit C. to match project fire alarm system requirements.**

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- C. Provide back boxes and mounting plates for [flush-mounting] [surface-mounting] [surface-mounting outdoors].
- D. Manufacturer: Fire Control Instruments, Inc., Model MS-2.

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**Edit paragraphs 2.8, 2.9 AND 2.10 to match project fire alarm system requirements. Coordinate with the LANL Fire Protection Group.**

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**2.8 THERMAL DETECTORS**

- A. Provide rate compensated, self-restoring thermal detectors that are acceptable to the FACP manufacturer and are compatible with the FACP .
- B. Provide detectors having a stainless steel shell and normally open contact.
- C. Temperature rating shall be determined by design unless shown otherwise on the Drawings.
- D. Provide horizontal detectors for areas that have suspended ceilings. Provide vertical detectors for equipment rooms and spaces without suspended ceilings.
- E. Manufacturer: Fenwal "Detect-A-Fire", Model 27021-0.

**2.9 IONIZATION DETECTORS**

- A. Provide dual chamber ionization type smoke detectors, 24 volts DC, field adjustable, with alarm light indicator. Provide detectors that are acceptable to the FACP manufacturer and are compatible with the FACP.
- B. Manufacturer: Hochiki "Low Profile", Model SIH-24F with Model HS-220D base.

## 2.10 PHOTOELECTRIC DETECTORS

- A. Provide photoelectric type smoke detectors, 24 volts DC, solid-state, utilizing integrated circuit components. Provide detectors compatible with and acceptable to the FACP manufacturer.
- B. Detector shall alarm when the smoke entering the sensing chamber reaches an obscuration level of 1.5 percent per foot.
- C. Detector shall contain an alarm indicator light which shall illuminate when the detector goes into an alarm condition.
- D. Provide means to functionally test the detector in the field without unplugging the unit or generating smoke.
- E. Manufacturer: Hochiki "Low Profile", Model SLK-24F with Model HS-220D base.

## 2.11 DUCT SMOKE DETECTOR HOUSING

- A. Provide duct smoke detector housing containing a photo- electric detector, and providing sampling through one inlet and one outlet tube. The duct smoke detector housing shall operate at 24 volts DC and shall provide an alarm indicator light, relay testing, and reset options. Detector housings shall be capable of sampling in air velocities ranging from 500 feet per minute to 3,500 feet per minute.
- B. Provide remote test and reset device in the vicinity of the detector. Indicate installation location on submittal shop drawings.
- C. Manufacturer: Hochiki, Model HA-UNI-(x)

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**Edit 2.12 to match project fire suppression system specifications. Change paragraph title to match system description.**  
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## 2.12 AUTOMATIC SPRINKLER SYSTEM

Refer to Section 15330 [15335] [15340] [15350] [15360] for pressure switches, flow switches and valve supervisory switches associated with the automatic sprinkler system.

## 2.13 CONDUIT

Refer to Section 16111 for conduit systems.

## 2.14 JUNCTION BOXES

Refer to Section 16130 for junction boxes.

## 2.15 WIRING

- A. Color Code: Use the following color code for the fire alarm system wiring:
  - Black - 120-Volt AC phase wire.
  - White - 120-Volt AC neutral wire.
  - Green - System ground wire.
  - Brown - Negative connection for strobe device.

Orange - Positive connection for strobe device.

Blue - Negative connection for horn circuit.

Yellow - Positive connection for horn circuit.

Gray - Negative alarm initiating device connection.

Violet - Positive alarm initiating device connection.

Black - Negative circuit connection for duct smoke detector reset, HVAC interlock and other auxiliary connections.

Red - Positive circuit connection for duct smoke detector reset, HVAC interlock and other auxiliary connections.

Black/Red Twisted Shielded Pair - Evacuation speaker circuit.

- B. Conductors: Provide alarm and supervisory signaling system conductors that meet the requirements of NFPA 70, Article 760 and are UL listed for the type of service to which they will be subjected. Minimum conductor requirements shall be as follows:
1. Low voltage conductors shall be type TFN, No.16 AWG (minimum), thermoplastic insulation, single solid copper conductor.
  2. Evacuation speaker cables shall be jacketed, two No.16 AWG (minimum) twisted and shielded, solid copper conductors.
  3. Power conductors shall be type THHN/THWN, No. 12 AWG, thermoplastic insulation, single solid copper conductor.
  4. Size conductors of the fire alarm systems as recommended by the manufacturer, based on the operating ampacity of the circuit and the permissible resistance and voltage drop characteristics that will allow proper operation of the equipment. Provide conductors selected to provide not more than 5% voltage drop to the most remote fire alarm device.

## 2.16 TEST EQUIPMENT

Provide any special test equipment manufactured by the fire alarm equipment manufacturer for maintenance, testing, or troubleshooting.

## PART 3 EXECUTION

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**Provide fire alarm system design information on the Drawings as required by the LANL Electrical Standards Manual. The requirements below are for the shop drawing level design required for a successful installation.**  
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### 3.1 SYSTEM DESIGN

- A. Provide the services of a qualified factory trained and certified fire alarm technician for the FACP installed on this project. The factory technician shall assure the completeness and correctness of the fire alarm system design by performing the following:
1. Prepare shop drawings of FACP indicating location of components, interconnection of components, and connections to alarm initiating, indicating, and auxiliary circuits.

2. Prepare shop drawings of fire alarm layout, conduit and wiring plans. Show location of FACP, all fire alarm appliances, conduit layout, quantity and type of wires in each conduit, and interface with other systems for functions such as central station signaling, fan shutdown, damper operation, and elevator recall.
3. Prepare terminal-to-terminal field wiring diagrams for alarm initiating, indicating and auxiliary circuits; detail the interfaces with other systems; indicate labeling of each fire alarm system conductor.
4. Calculate conductor sizes for each alarm initiating, indicating and auxiliary circuit; limit voltage drop to 5% to the most remote device on each circuit.
5. Prepare battery load calculations and select proper battery size.
6. Calculate alarm signal in all spaces to comply with ADAAG requirements: minimum 15 dBA above ambient, but not over 120 dBA at any location.
7. Select alarm initiating, alarm indicating, and auxiliary devices compatible with FACP.

### 3.2 FIELD CONDITIONS

- A. Prior to installation carefully inspect the installed work of other trades, whether pre-existing or part of this project and verify that such work is complete to the point where the installation of the fire alarm system may properly commence.
- B. Notify the Contract Administrator should conditions exist, not resulting from work of this project, that prohibits the installation from conforming to applicable codes, regulations, standards and the original approved design.

### 3.3 INSTALLATION

- A. General:
  1. Install the fire alarm system in accordance with NFPA 70, NFPA 72, and this specification.
  2. Refer to Section 16195 for supporting device requirements for fire alarm cabinets, conduit and equipment.
  3. Verify dimensions in the field. Lay out work in the most direct and expeditious manner to avoid interferences.
  4. The Drawings show only approximate building outlines and interior construction details as an aid in understanding the scope of work. Investigate the structural and finish conditions affecting the work and arrange work accordingly.
  5. Coordinate necessary shutdowns of existing systems by notifying the Contract Administrator a minimum of seven working days before rendering such systems inoperative. Do not render inoperative, any system, without the prior approval of the Contract Administrator. The Contract Administrator will initiate and submit the LANL Fire Protection Impairment Procedure.
  6. Coordinate fire alarm detectors and associated equipment with existing ceiling or roof materials, lighting, ductwork, conduit, piping, suspended equipment, structural and other building components.
  7. Coordinate installation of fire alarm system with work of other trades. Protect fire alarm equipment with suitable coverings until completion of Project.

8. Dispose of equipment removed for completion of this job as directed by the Contract Administrator.
- B. Device Mounting Heights:
1. Install manual pull stations with center 42 inches above finished floor.
  2. Install combination audible/visual devices with the bottom of the device 80 inches above finished floor or 6 inches below ceiling, whichever is lower.
  3. Comply with ADA Accessibility Guidelines (ADAAG) for device mounting heights and locations.
- C. FACP Installation
1. Install FACP following manufacturer's written instructions, NFPA 72 and NFPA 70.
  2. Install FACP with top of cabinet trim 6'-2" (maximum) above finished floor.
  3. Mount FACP plumb and rigid without distortion of the box. Mount flush cabinets uniformly flush with wall surfaces.
  4. Install filler plates in unused spaces in FACP.
  5. At flush FACP stub four 1-inch empty conduits from cabinet into accessible ceiling space or space designated to be ceiling space in future. Stub four 1-inch empty conduits into raised floor space or below slabs other than slabs on grade.
  6. Train conductors in cabinet gutters neatly in groups; bundle and wrap with cable ties after completion of testing.
  7. Tighten electrical connectors and terminals, including grounding connections, according to the manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A.
  8. Mark floor in front of cabinet to show NFPA 70 required working clearances according to Section 16195 -- Electrical Identification.
- D. Wiring Installation:
1. Install fire alarm system wiring in raceway.
  2. Do not pull wire or cable until the conduit system is complete between pull points.
  3. Bundle conductors in panels and boxes in groups by service and destination.
  4. Run electronic cable continuous between termination points. No splicing is permitted without prior approval from the Contract Administrator.
  5. Make allowances in conductor length at panels and other enclosures to permit forming the conductors neatly within the enclosures. Where wiring troughs are not provided with the enclosures, neatly cable and adequately support the wiring.
  6. Ring out and identify power and control conductors before terminal connections are made. Check polarity and phasing and make changes as required before making terminal connections.
  7. Test conductors for continuity and for freedom from shorts or unintentional grounds.

E. Junction Box Installation:

1. Refer to Section 16160 for installation requirements.
2. Label fire alarm junction boxes with 2-1/4" x 1/2" (minimum size) pressure sensitive vinyl markers having "FIRE ALARM" in red letters on a white background.

F. Conduit Installation:

1. Refer to Section 16111 for conduit installation requirements.
2. Space fire alarm cable and conduit six inches away from power cable and conduit.

G. Conductor Identification

1. Label each conductor at each terminal and junction point.
2. Use wire markers specified in Section 16195 – Electrical Identification.
3. On wire markers indicate the type of fire alarm circuit (e.g. Pull Stations, Fan Shutdown, Alarm Strobes, etc.).

### 3.4 PAINTING

A. Exposed Surfaces: Paint exposed fire alarm conduit, panels, cabinets, pullboxes, supports, and other electrical equipment as follows:

1. Galvanized Surfaces: Paint for repairing galvanized materials shall be zinc-rich type.
2. Refinishing: Thoroughly clean and touch up shop primed or finish painted surfaces damaged in handling or installation with paint supplied with the equipment or an approved matching paint.
3. Interior Conduit: Paint new exposed interior conduit in rooms finished and/or occupied to match the existing background paint color. Paint conduit to be painted with one coat of primer. Paint conduit to match the existing background colors with two coats of paint to provide a minimum thickness of 6 mils.

### 3.5 CONNECTION TO CENTRAL STATION

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**Select A. or B. to match project fire alarm system requirements.**

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- A. Install 3/4" conduit from fire alarm cabinet to telephone board. Install pull tape in conduit.
- B. Install 3/4" conduit from fire alarm cabinet to concentrator panel. Install pull tape in conduit.
- C. After fire alarm system is acceptance tested and is fully operational, the University will install and terminate a communication cable.

### 3.6 EQUIPMENT INSTALLATION

Install devices or equipment not specifically covered by these specifications in accordance with manufacturer's instructions.

### 3.7 CLEANING

Blow out junction boxes and fire alarm equipment not hermetically sealed with clear, dry, oil-free (15 psig maximum) air to remove dust and dirt prior to energizing.



### 3.8 FIELD QUALITY CONTROL

- A. Provide the services of a qualified factory trained and certified technician for the FACP installed on this project. The factory technician shall assure the completeness and correctness of the installation by performing the following:
  - 1. Prepare as-built documentation of FACP indicating location of components, interconnection of components, and connections to alarm initiating, indicating and auxiliary circuits.
  - 2. Field verify and mark as-built shop drawings of fire alarm layout, conduit and wiring plans, and point-to-point field wiring diagrams.
  - 3. Verify correct labeling of fire alarm system conductors.
  - 4. Verify that conductor sizes are adequate for each alarm initiating, indicating and auxiliary circuit.
  - 5. Prepare as-built battery load calculations.
  - 6. Measure and adjust audible alarm signal in all spaces to comply with ADAAG requirements: minimum 15 dBA above ambient, but not over 120 dBA at any location.
  - 7. Test all devices for proper supervision and alarm operation.
  - 8. Test all interlocks with HVAC and elevator system for proper operation.
  - 9. Perform pre-final acceptance inspections and tests of the fire alarm system modifications.
  - 10. Prepare final acceptance test plan.
- B. After the pre-final test, provide a report to the LANL Project Leader indicating the status of the fire alarm system and any corrective actions required before the acceptance tests.
- C. Submit a detailed test plan for the final acceptance test.
  - 1. Submit the test plan not less than 10 working days before the planned final acceptance date.
  - 2. Follow test methods outlined in Chapter 7 of NFPA 72.
- D. Coordinate date of final acceptance test with installer, HVAC sub-contractor, LANL Project Leader and the LANL Fire Protection Group representative. Make corrective actions before final acceptance test date.

### 3.9 FINAL ACCEPTANCE TEST

- A. Notify Contract Administrator 2 working days in advance of final acceptance tests. Perform final acceptance tests in the presence of an authorized representative of the Contract Administrator.
- B. Before the final acceptance test begins, present a preliminary copy of the Certificate of Completion to the authorized representative of the LANL Contract Administrator.
  - 1. Preliminary Certificate of Completion shall be of the form required by NFPA 72.
  - 2. Indicate on the preliminary Certificate of Completion that the pre-final inspections and tests have been performed and all corrective actions have been completed.
  - 3. The final acceptance test will not proceed before the Certificate of Completion is presented to the authorized representative of the LANL Contract Administrator.

- C. Perform final acceptance tests on the completed fire alarm system:
  - 1. Follow the approved test plan and comply with NFPA 72 requirements.
  - 2. Test FACP and the connected initiating, alarm, and auxiliary devices.
  - 3. Perform discharge test on the FACP battery.
  - 4. The University will perform tests on connections made by the University.
- D. At the final acceptance test, have marked-up shop drawings and point-to-point wiring diagrams available for review and verification. Final acceptance test will not proceed without these as-built documents. If LANL verification of the as-built documents reveals errors, re-verify the complete fire alarm raceway and wiring system in the presence of a LANL Fire Protection Group representative.
- E. Correct deficiencies discovered in the final acceptance test and re-test fire alarm system until satisfactory test results are obtained.
- F. Upon successful completion of acceptance tests, submit a final "Certificate of Completion" and "Inspection and Testing Form" as required by NFPA 72.

### 3.10 SYSTEM IDENTIFICATION PLACARD

- A. Furnish and install a permanently mounted placard in or adjacent to the fire alarm control cabinet.
- B. Provide the following information typewritten or engraved on the placard:
  - 1. Name, address and phone number of installing contractor.
  - 2. Reference to the standards, including date of issue, to which the system conforms (e.g. NFPA 72 1993 Edition and NFPA 70, 1996 Edition).
  - 3. Circuit number of power supply to FACP and location of the electrical panelboard.
  - 4. Location of fire alarm system Operating and Maintenance Instructions if they are not stored in the FACP cabinet.
  - 5. Location of fire alarm system as-built documents.

END OF SECTION